(1)

REPORT OF SURVEY CONDUCTED AT

STANDARD INDUSTRIES

LA MIRADA, CALIFORNIA

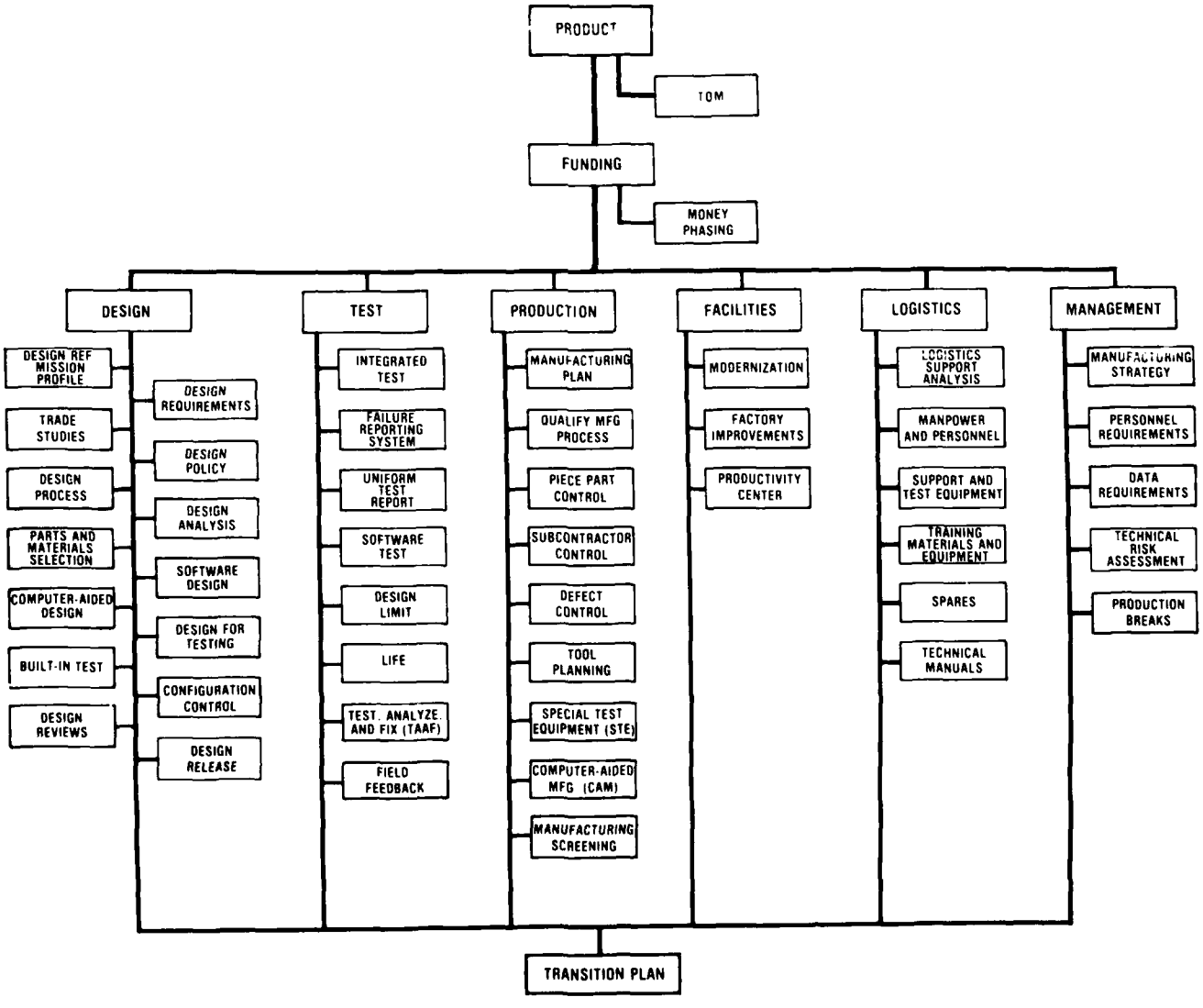
JUNE 1989

BMP

DoD 4245.7-M

"TRANSITION FROM DEVELOPMENT TO PRODUCTION"

CRITICAL PATH TEMPLATES



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The purpose of the Best Manufacturing Practices (BMP) survey conducted at this facility was to identify their best practices, review manufacturing problems, and document the results. The intent is to extend the use of progressive management techniques as well as high technology equipment and processes throughout the U.S. industrial base. The actual exchange of detailed data will be between contractors at their discretion. ~~A company~~ point of contact is listed in the report.

The intent of the BMP program is to use this documentation as the initial step in a voluntary technology sharing process among the industry. (SW)

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SECTION 1

EXECUTIVE SUMMARY

The Best Manufacturing Practices (BMP) team conducted a survey at Standard Industries located in La Mirada, California. The purpose of the survey was to review and document the best practices and potential industry-wide problems at Standard. The intent of the BMP program is to use this documentation as the initial step in a voluntary technology sharing process among the industry.

1.1 KEY FINDINGS

Many best practices were observed at Standard Industries and are detailed in this report. Some of the most significant findings are summarized below.

SECTION 2
INTRODUCTION

2.1 SCOPE

The Best Manufacturing Practices (BMP) survey conducted at Standard Industries marks a new direction in the Navy's BMP Program. Previous surveys focused exclusively on large Department of Defense (DoD) prime contractors and their subsidiary companies. BMP is now expanding its program to include small contractors. These companies, which account for a significant portion of defense spending, have much to offer in innovative practices. The Standard Industries survey is the first of several small business surveys scheduled over the coming months.

The purpose of the BMP surveys is to identify best practices, review manufacturing problems, and document the results. The intent of these reviews is to extend the practice of progressive management techniques and the use of high technology equipment and processes throughout industry. BMP's ultimate goal is two-fold: to reduce the life cycle cost of defense systems and to strengthen the U.S. industrial base. This goal is realized through the use of techniques and technologies to solve manufacturing problems and to improve quality and reliability.

In support of the BMP goal, a team of Navy engineers accepted an invitation from Standard Industries to review and document the advanced manufacturing processes and techniques used at their facility in La Mirada, California. The survey was conducted 28-29 June 1989 by the team identified in Appendix B.

The results of BMP surveys are entered into a data base to track the best practices currently available and common manufacturing problems identified by industry. The information from the surveys is available for dissemination through this easily accessible computer data base. The actual exchange of detailed technical data takes place between companies at their discretion on a strictly voluntary basis.

The results of this survey should not be used to rate Standard Industries among other defense contractors. A contractor's willingness to participate in the BMP Program and the survey results have no bearing on one contractor's performance over another's. *The documentation in this report and other BMP reports is not intended to be all-inclusive of a contractor's best practices and problems. Only selected nonproprietary practices are reviewed and documented by the BMP survey team.*

The process of selecting topics which are documented as best practices is subjective and is partially determined based on company-selected topics presented during the survey. Best practices are also selected by the survey team members' evaluations based on personal experience and observations at other companies. With the addition of small business surveys to the BMP program, best practices were evaluated from a small-company perspective. What might have been considered a best practice for a small company of limited resources may not have been considered a best practice in a large company with greater resources and capabilities. Based on these ideas, the survey team found that Standard Industries did indeed have some best practices to share.

2.2 SURVEY PROCESS

This survey was performed under the general survey guidelines established by the Department of the Navy. Survey concentration was on the functional areas of design, test, production, facilities, logistics, and management. The team evaluated Standard Industries' policies, practices, and strategies in these areas. Individual practices reviewed were also characterized as they relate to the critical path templates of DoD 4245.7-M, "Transition from Development to Production." Standard Industries identified potential best practices and industry-wide problems. These and other topics were discussed, reviewed, and documented for distribution throughout the U.S. industrial base.

The survey format included formal briefings and discussions on best practices and problems. Team members spent time on the production floor reviewing practices, processes, and equipment. In-depth discussions were conducted to more completely understand and document the identified best practices and problems.

2.3 NAVY CENTERS OF EXCELLENCE

Demonstrated industry-wide problems identified during the BMP surveys may be referred to one of the Navy's Centers of Excellence listed below.

- Electronics Manufacturing Productivity Facility (EMPF) - Ridgecrest, CA

The EMPF conducts applied research in the processes and materials involved in the manufacture of circuit card assemblies.

- Metalworking Technology Incorporated (MTI) - Johnstown, PA

  MTI conducts applied research in the metalworking processes.

- Automated Manufacturing Research Facility (AMRF) - Gaithersburg, MD

  The AMRF conducts applied research in the machining processes within a heterogeneous computer integrated manufacturing environment.

2.4 STANDARD INDUSTRIES OVERVIEW

Standard Industries manufactures electronic components for the aerospace industry, and provides design engineering and quality production of electromagnetics and power supply products. The business was established in 1953 and has grown to occupy an 80,000 square foot facility in La Mirada, employing approximately 65 people.

Standard Industries offers technical capabilities to a wide range of aerospace and industrial customers. These capabilities include design, development, qualification testing, and production of military power supplies, as well as electromagnetic interference filters and magnetic components such as transformers and coils. Manufacturing capabilities also incorporate metalforming, machining, and fabrication operations.

Components produced by Standard Industries are used in DoD programs such as Minuteman, Sidewinder, Sparrow, Phoenix, Chaparral, Trident, Peacekeeper, all nuclear attack submarines, the Joint Tactical Information Distribution System (JTIDS), and Hagar. Space programs include Gemini, Apollo, Viking, Voyager, and the shuttle, as well as the Space Telescope, Galileo and Geo-Positioning Satellite System. The F-4, F111, F-15, B-1, and B-2 aircraft operate using Standard Industries components. The company is currently designing and qualifying parts for many advanced programs.

Standard Industries possesses a unique personality characterized by the company's involvement in acquiring and restoring classic railroad coaches. This enterprise which began as a personal interest of the owners has developed into an additional source of company revenue. This creative use of resources exemplifies the company's development of some impressive capabilities.

2.5 ACKNOWLEDGMENTS

Special thanks are due to all the people at Standard Industries whose participation made this survey possible, especially the company's senior management team. Although a significant number of the company's personnel participated in the survey, the BMP team particularly acknowledges the special efforts of Mr. Bud Reed, President of Standard Industries. His enthusiastic support of the BMP team during all phases of the survey was greatly appreciated, and his dedication significantly affected the survey's success. Mr. Reed's commitment to be the first small business to host a BMP survey required foresight and was highly commendable.

2.6 STANDARD INDUSTRIES POINT OF CONTACT

While the information included in this report is intended to be descriptive of the best practices observed at Standard Industries, it is not intended to be all-inclusive. More detailed information on a particular topic can be obtained by contacting the company directly. Any exchange of technology or data resulting from such contact is strictly voluntary and at the discretion of Standard Industries.

The point of contact at Standard Industries for the Best Manufacturing Practices Program is:

Mr. James R. (Bud) Reed, President
Standard Industries
14250 Gannet St.
La Mirada, CA 90638
Telephone: (213) 868-0891
Fax: (714) 521-9531

SECTION 3
BEST PRACTICES

3.1 DESIGN

DESIGN REVIEW

Engineering Review

Standard Industries operates essentially as a "job shop", with business which consists of high mix, low volume products that are built to print. However, unlike many job shops, Standard has capable and experienced inhouse engineering resources. For new and repeat business, the technical design is carefully reviewed to ensure that the product is producible, will perform as required, and the documentation is correct. When handling repeat jobs, any changes in processes or materials since the last order are checked. This engineering review process is a team effort. Design documentation and the work instruction floor package is critically reviewed by all key design, manufacturing, quality, material control, and accounting personnel before release. The floor package which travels with the job contains a "Request for Engineering Review" form on which personnel involved with the job can document a problem and suggest a solution or recommend an improvement. The use of this form results in a mandatory review and follow-up by the engineering department. This effective process has addressed and solved many problems such as detecting documentation errors. Other examples demonstrated how the process improved product producibility or performance which resulted in significant cost and schedule savings for the customer.

3.2 TEST

INTEGRATED TEST

In House Analysis Resources

Standard Industries has made a significant commitment to building its capabilities in specific technical areas. As a small company, choices involving the application of limited resources become critical. Standard has upgraded its capabilities in areas such as test equipment which are essential to its business. Unlike larger prime contractors whose test equipment costs are often partially underwritten by government programs, small companies like Standard fully fund their own test equipment purchases.

Standard has made significant investments in test equipment to upgrade its in-house analysis resources. An HP-4194A Impedance Gain/Phase Anaiyzer, which was needed to support the company's growing power supply business, was recently acquired. With the purchase of a Biddle Partial Discharge Test System, Standard has implemented corona testing on high voltage transformers and power supplies. The tester has the capability to detect down to one pico-coulomb at 100 kilo volt. Tests are performed to ensure that the final product will meet high voltage requirements without degradation of reliability. X-ray inspection is another system capability. Product samples are x-rayed to ensure that process controls are effective in keeping coil wire turns in proper alignment, that proper part positioning is maintained within the potting material, and to check for voids or inclusions. This nondestructive testing method has also proven effective in detailed examination of failed parts.

Standard has also invested in equipment for performing various environmental tests such as humidity, vibration, thermal cycling, and life testing. This capability is utilized in qualification tests, first article testing, and special evaluations. The equipment can also be used to test and verify the performance of new products.

DESIGN LIMIT

Continuing First Article Requirement

Many of Standard Industry's customers and the Government require by contract that first article testing be conducted prior to the start of a production lot run. Standard extends this practice to the start of any lot even when not required by the prime contractor or the Government. The practice is also followed if one of several instances arise. These situations include a substantially long time since the last build; a turnover of assembly personnel experienced with a specific part; any prior difficulties in production; or any suggested process enhancements. These conditions frequently arise since Standard manufactures several thousand different items, often with significant time between orders for a given part. This practice of completing nonrequired first article testing was viewed as an indication of Standard's commitment to quality.

3.3 PRODUCTION

MANUFACTURING PLAN

Production Control

Standard Industries has implemented an effective on-line system for tracking the status of work in process by using Job Shop 3000, a commercial software package produced by Votaw Data Systems Inc. The software which runs on an HP-3000 computer has been customized for Standard's specific application. Job Shop 3000 provides current status for each work order, including quantities ordered and completed, unit and lot prices, schedule and budget performance, and long lead items. With Standard's low volume, high mix product line, this system serves as an excellent tool for planning and controlling work.

SUBCONTRACTOR CONTROL

Subcontractor Teaming

Standard Industries has made innovative use of excess plant space to provide a unique teaming arrangement with two suppliers. A machine shop and a cable/harness fabricator rent excess factory floor space from Standard. The result is a symbiotic relationship benefiting both Standard Industries and the tenant companies. In return for a nominal rent, the tenant companies provide priority service to Standard at pre-agreed hourly rates. This practice guarantees a quick turnaround time on jobs. Communicating requirements and resolving problems is easier having suppliers located on site.

This teaming arrangement gives Standard Industries significant production capability without associated overhead. As preferred suppliers, the tenants are assured substantial business from Standard Industries. Although Standard has its own machine shop, the tenant shop can handle overflow work and provide skilled machinists using state-of-the-art machinery. This arrangement also provides entrepreneurial associates a beneficial start-up opportunity with minimal risk and a built-in market.

The company is seeking other appropriate situations that compliment Standard Industries' operations. The company also rents excess warehouse space to several other unrelated businesses thereby providing income and productive use of space. If needed, that space is then available for expansion.

TOOL PLANNING

Slush Tooling

Standard has developed "slush tooling," a unique mold construction technique used for short production run potting applications. This technique has worked well with Standard's practice of producing short runs of many different types of items. Hard tooling is made from machined aluminum in the required mold shape. When needed, the aluminum tool is dipped in a special low melting temperature alloy and coated. The material cools rapidly and expands slightly, making removal of the solidified alloy shell from the tool relatively easy. The alloy shell is then used as the mold for the potting operation. If the aluminum tool is cooled after repeated use, an unlimited number of molds can be produced. The alloy mold is melted and recycled if it is damaged or no longer needed.

3.4 FACILITIES

FACTORY IMPROVEMENTS

Winding Techniques for Coils

Standard's innovative use of existing resources is also exemplified by their ability to make capability improvements to existing manufacturing equipment. Off-the-shelf precision winding machines have been modified for use in high voltage coil applications where accuracy in spacing, location, and number of turns in the windings is required. A ratiobar pantograph adjustment has been added to one of the Stevens winding machines. A micrometer/microswitch margin adjustment to a Microfil machine for precision winding of wire layers in high voltage applications has also been completed. Modifying existing equipment has been a principal method at Standard for economically meeting the needs of the customer and making products more producible.

Vacuum Impregnation/Encapsulation

Standard has also designed and built vacuum impregnation equipment. This equipment is capable of pouring preheated evacuated resin or oil into units at an adjustable rate of flow under vacuum down to 50 microns. The resin is then cured under dry nitrogen pressure up to 120 psi.

3.5 MANAGEMENT

PERSONNEL REQUIREMENTS

Employee Involvement

Standard Industries' 65 employees are given considerable say in the company operation. Good job performance is recognized and rewarded in several ways. A President's Award is presented quarterly to the employee recommended by management or supervisory personnel and selected by the company president. The award includes a plaque, cash award, and a preferred parking space. Quarterly meetings are held at which all employees are briefed on the status of the company including costs and profits. At this meeting, each employee is given a cash bonus based on profitability. Employees are also eligible for an instant cash "mini" bonus of up to $50 at the discretion of the department manager for exceptional performance. These programs foster a strong employee loyalty and sense of involvement, encouraging the staff to develop ways to improve products, processes, and producibility.

Good communication in the company at all levels is strongly evident. Employees are kept informed on the status of current operations and are aware of the end use of the parts they are producing and the function of these parts in the overall system. All of these examples of employee involvement have resulted in the low employee turnover rate at Standard.

TECHNICAL RISK ASSESSMENT

Management Cycle Time

An obvious company strength is its ability to make decisions and take action quickly. The management team is a small, closely knit group with effective interaction and communication skills. Each manager has full authority to make decisions affecting his area of responsibility. The president and department managers spend much time on the production floor directly involved in the day-to-day operations. Management is experienced and technically competent. The company is therefore able to respond rapidly to problems and take advantage of opportunities as they arise.

SECTION 4
PROBLEM AREAS

4.1 PRODUCTION

SUBCONTRACTOR CONTROL

Prime Contractor Relationships

Standard Industries identified several problem areas in relationships with large prime contractors that it believes are common in industry.

There is a limited recognition by prime contractors and the Government that many small subcontractors have extensive engineering and technical capability in their product specialty areas. Standard Industries cited several examples of situations where the company's in-house design review process identified documentation, producibility, or performance problems. Although brought to the attention of the prime contractor, the problems were ignored and the contractor required the products to be built to specification. When a part would not perform as required, it was reordered with the incorporated necessary changes. Standard states that an effective solution to this problem would be for prime contractors to allow reputable potential suppliers to review designs prior to release for bid.

When design, manufacturing, or test problems are identified and solutions proposed to the prime, the response time is normally quite long. This delay is in part due to the group decision making process existing in many large companies and requiring several layers of management review and approval. The lack of response can be costly to the subcontractor and ultimately result in the subcontractor taking the most expedient course to avoid cost or penalties for delaying production.

The subcontractor rating systems developed and used by many prime contractors can be counter-productive. The suppliers are typically highly scored for shipping a part by the required date, but appropriate credit to those who make a conscientious effort at design producibility and performance is not considered. A lower quality product delivered on time will ultimately increase life cycle cost and degrade performance.

QUALIFY MANUFACTURING PROCESS

Soldering Training

Training requirements for certifying personnel in accordance with WS-6536 and DOD-STD-2000 are difficult to accomplish. The course dates are backlogged and there is a waiting list. For a small company, this annual two week certification course requires considerable expense and time away from the job for key personnel.

Standard Industries has developed and currently operates an in-house soldering training program which all new employees must complete. The company wrote its own soldering manual now used as the text for the training program. The text and pictures were adapted from MIL-S-45743, WS-6536, MIL-STD-454 Requirement 5, and has been augmented as required for high voltage applications. The training program is presently being reviewed for compliance with MIL-STD-2000.

DEFECT CONTROL

Implementation of Statistical Process Control in the Job Shop

Standard Industries is aware of the benefits of statistical process control (SPC), but has experienced difficulty in finding an effective way to implement it in the job shop environment. Operations that would effectively use SPC include those that are sufficiently constant regardless of the part number being processed.

Although formal SPC is not in place at Standard, an informal system exists which is effective because of the close working relationships in the company. Critical processes and parameters are identified and checked by test department personnel for conformance to the requirements. This process reduces cost by eliminating all but the most essential testing. The test department reports to the production manager with constant quality assurance surveillance for quick conflict resolution. Test failures attributed to production operations are discussed with the operator. This feedback helps to resolve problems as they arise and prevent future recurrence.

APPENDIX A

LIST OF ACRONYMS

BMP	Best Manufacturing Practices
DoD	Department of Defense
JTIDS	Joint Tactical Information Distribution System
SPC	Statistical Process Control

APPENDIX B

BMP REVIEW TEAM

TEAM MEMBER	AGENCY	ROLE
CDR Rick Purcell (202) 692-3422	Office of the Assistant Secretary of the Navy RM&QA-PI (S&L) Washington, DC	Team Chairman Management and Logistics
CDR Mark Cooper (805) 756-2571	NAVSEA DET 519 Long Beach, CA	Design & Test
Larry Robertson (812) 854-3085	Naval Weapons Support Center Crane, IN	Production and Facilities

APPENDIX C

PREVIOUSLY COMPLETED SURVEYS

BMP surveys have been conducted at the companies listed below. Copies of survey reports for any of these companies may be obtained by contacting:

Best Manufacturing Practices Program
Office of the Assistant Secretary of the Navy
(Shipbuilding and Logistics)
Attn: Mr. Ernie Renner, RM&QA
Washington, DC 20360-5100
Telephone: (202) 692-0121

Litton
Guidance & Control Systems Division
Woodland Hills, CA
October 1985

Texas Instruments
Defense Systems & Electronics Group
Lewisville, TX
May 1986

Harris Corporation
Government Support Systems Division
Syosset, NY
September 1986

Control Data Corporation
Government Systems Group
Minneapolis, MN
December 1986

ITT
Government Systems Group
Clifton, NJ
September 1987

UNISYS
Computer Systems Division
St. Paul, MN
November 1987

General Dynamics
Fort Worth Division
Fort Worth, TX
May 1988

Honeywell, Inc.
Underseas Systems Division
Hopkins, MN
January 1986

General Dynamics
Pomona Division
Pomona, CA
August 1986

IBM Corporation
Federal Systems Division
Owego, NY
October 1986

Hughes Aircraft Company
Radar Systems Group
Los Angeles, CA
January 1987

Rockwell International Corporation
Collins Defense Communications
Cedar Rapids, IA
October 1987

Motorola
Government Electronics Group
Scottsdale, AZ
March 1988

Texas Instruments
Defense Systems & Electronics Group
Dallas, TX
June 1988

Hughes Aircraft Company
Missile Systems Group
Tucson, AZ
August 1988

Bell Helicopter
Textron, Inc.
Fort Worth, TX
October 1988

Litton
Data Systems Division
Van Nuys, CA
October 1988

GTE
C3 Systems Sector
Needham Heights, MA
November 1988

McDonnell Aircraft Company
St. Louis, MO
January 1989

Northrop Corporation
Aircraft Division
Hawthrone, CA
March 1989

Litton Systems, Inc.
Applied Technology Division
San Jose, CA
April 1989

Litton Systems, Inc.
Litton Amecon
College Park, MD
June 1989

Information gathered from all BMP surveys is included in the Best Manufacturing Practices Management Information System (BMP-MIS). Additionally, a calendar of events and other relevant information are included in this system. All inquires regarding the BMP-MIS may be directed to:

Director, Naval Industrial Resources Support Activity
Attn: BMP-MIS System Administrator
Bldg. 75-2, Room 209, Naval Base Philadelphia, PA 19112-5078
Telephone: (215) 897-6684